Japanese Dental Science Review (2015) 51, 65—74

ScienceDirect

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Review Article

Education on tobacco use interventions for undergraduate dental students

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Received 29 May 2014; received in revised form 3 March 2015; accepted 13 March 2015

KEYWORDS
Dental education;
Dental hygiene school;
Tobacco use intervention;
Smoking cessation

Summary Inadequate training for dental professionals hampers the implementation of tobacco use interventions for the improvement of dental practice and oral and overall health. To improve dental education regarding tobacco use prevention and cessation (DENTUPAC), we examined literature addressing previous efforts and experiences with this goal. The majority of studies, published in the US and Europe, reported that a transition from didactic to clinical education achieved moderate-level interventions. The need for a comprehensive multidisciplinary approach and the low confidence of faculty members in their own ability to effectively teach DENTUPAC are commonly reported barriers to DENTUPAC in clinical settings. Objective structured clinical examinations of standardized patients and motivational interviewing have proven consistently successful in DENTUPAC and are included in faculty development workshops and internet-based training. However, levels of intervention from dentists on quitting smoking

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http://dx.doi.org/10.1016/j.jdsr.2015.03.003

reported by their patients were relatively low compared to those from physicians, although most dentists reported that they counsel patients. In addition to previous efforts and experiences in developing and disseminating DENTUPAC, the optimization of DENTUPAC by evaluating education on health behavior interventions may help increase the involvement of dentists in cessation counseling upon graduation.

Contents

1. Introduction

Tobacco use and exposure to tobacco smoke harms oral and overall health and affects the outcomes of dental treatment, while cessation of tobacco use reduces and often reverses these deleterious effects. Dental professionals are in a unique position to encourage tobacco use cessation, as they routinely encounter smokers and can alert them to their symptoms at an early time point. However, few take full advantage of this opportunity due to lack of training. Emphasis is therefore being placed on dental education regarding tobacco use prevention and cessation (DENTUPAC) [1,2].

Global efforts to control tobacco use have increased with the introduction of the World Health Organization (WHO) Framework Convention on Tobacco Control. This framework recommends measures to improve education, communication, and training to raise public awareness, promote the cessation of tobacco use, and provide adequate treatment for tobacco dependence [3]. We would therefore like to propose measures to further improve efforts to educate dental professionals-in-training on ways to encourage cessation among their tobacco-using patients.

In Japan, the smoking rate of 32.2% reported among adult males in 2013 is high compared to other developed countries. In addition, the increased proportion of adult females who smoke (10.5% in Japan) is an important issue globally. For the first time in Japan, a numerical goal of a 12.2% smoking rate for both males and females by 2022 was included in the second term of the Health Promotion Act to promote tobacco cessation on a national scale. In Japan, where smokeless tobacco has only recently begun to be used on any scale, tobacco use interventions were first described in the clinical competency guidelines for dental and dental hygiene students and in the standards of the National Board Dental and Dental Hygiene Examinations. Here, to identify recommendations to improve DENTUPAC in Japan and other countries, we analyzed previous reports from the viewpoints of good dental practice and public health.

2. Review process

Literature was selected from the reference list of our previous review [2]. Electronic searches were conducted using MEDLINE (January 1966—August 2012) for reports published in English. A standardized search strategy (not shown) was applied to databases. The reference lists of articles read in full were also considered, and search results were stored in literature management software (iPubMedMaker 7, Sapporo, Japan) for initial screening based on titles and abstracts. After excluding studies that addressed the relationship between tobacco and oral health, a total of 754 papers published in English were extracted. The titles and abstracts were read, with 366 papers ultimately selected for

initial review. Of these papers, 73 addressed DENTUPAC, and 2 were added from reference lists. In total, 75 papers were used for this review.

The majority of studies were reported by the WHO in North America (71%) and Europe (15%) (Fig. 1A). Two thirds of studies were conducted in the US specifically, with less than five papers reported in each WHO region outside of Europe or the US. The earliest paper on the subject was published in 1989, with the number of publications increasing by approximately 10 every 5 years (Fig. 1B). Students were examined in approximately 40% of studies (Fig. 1C), while other studies addressed organizations, faculty, and dental patients, and reported recommendations. Given that dental education guidelines are typically specific to each country, the native language is commonly used to exchange information regarding DENTUPAC. As this review only includes articles written in English, global educational activity might therefore be underestimated.

Information on components of DENTUPAC was extracted and gathered according to barriers and facilitators of program implementation, educational contents and methods, and assessments of students and programs from the viewpoint of good practice. Finally, a potential strategy of DENTUPAC was formulated after considering both points of view. As literature regarding the education of future dentists and dental hygienists was reviewed, the term ''dental education'' refers to the education of both types of students, unless otherwise specified. As literature regarding the education on interventions of smokeless tobacco use and smoking was reviewed, the term ''tobacco use interventions'' refers to the interventions of use of any types of tobacco, unless otherwise specified.

3. Perspectives of DENTUPAC

3.1. Development of DENTUPAC

Behaviors towards tobacco use and attitudes towards tobacco control among medical students were evaluated in a global survey in 1994 [4] and again among dental students in 2011 [5]. As DENTUPAC was first surveyed in US dental schools during the 1980s [6,7], the subsequent lapse in the global expansion of dental education implies greater obstacles to implementation in dental than in medical education settings.

Global DENTUPAC development can be divided into four stages according to improvement in quality of and diffusion of education (Table 1). In Stage I (1989—1999), DENTUPAC was introduced and disseminated in US dental schools. In Stage II (2000—2004), educational contents and methods were subsequently improved. In Stage III (2005—2009), educational programs were reevaluated and expanded to European countries. In Stage IV (2010—present), the need for an educational model based on clinical competency for moderate-level interventions was met through the global extension of education.

3.2. Progress in US dental schools

Availability of information on DENTUPAC was limited until 1988. A survey of dental hygienists of various age groups following graduation suggested that improvement in DENTUPAC increased the rate of tobacco use interventions over time due to increasingly positive attitudes and behavior regarding these interventions in younger age groups [8]. Establishment of workplace smoking policies in dental schools also ensured that attitudes shifted toward involvement in smoking cessation interventions due to the need for such interventions among students and faculty members themselves [6,7].

However, despite the introduction of lectures regarding pathologies associated with tobacco use, the initial success of DENTUPAC was limited [9]; indeed, as of 2000, only 50% of dental schools had adopted DENTUPAC programs [10]. Information on good practice regarding DENTUPAC was then shared among schools [11—13]. Activities of dental schools regarding inquiries into tobacco use and documentation in on-campus clinics for college students, which represent the starting point of tobacco use interventions, increased from 74% in 1990 [7] to 84% in 1993 [9], and then to 100% in 1998 [10]. These findings indicate that all dental schools were prepared to educate students on tobacco use interventions.

In the last decade, DENTUPAC has become widespread in US dental schools, and the American Legacy Foundation has allowed the American Dental Education Association to facilitate the integration of model tobacco-related curricula into dental courses [14]. However, the methods used to assess tobacco use were inconsistent among schools [15], and relatively few patients in dental student clinics were aware of community resources for tobacco use interventions [16]. Further, while dentists estimated the tobacco use of their patients more accurately than physicians and other health professionals [17,18], dentists were less frequently involved in intervention than physicians and other health professionals [17], with only 14% of dental students claiming confidence in their implementation of tobacco use interventions after graduation [19]. Although the level of intervention advocated in the DENTUPAC program varied significantly by dental hygiene school [20], dental hygiene students were overall more competent and confident than dental students regarding tobacco use interventions. This discrepancy may be due to gaps in the quality of counseling education among dental schools [21].

As of 2009, DENTUPAC was implemented in 90% of dental schools [22], and approximately 70% of US dental hygiene program directors expected their graduates to competently deliver moderate-level intervention [23]. A moderate-level intervention was defined as a 5- to 15-min interaction consisting of the 5 As (Ask, Advise, Assess, Assist, and Arrange) and the 5 Rs (Relevance, Risks, Rewards, Roadblocks, and Repetition) involving brief motivational interviewing and discussion of cessation medications. DENTUPAC remains a top priority among interventions of prevention of oral diseases and health promotion in US dental schools [24].

3.3. Global perspective

Reports on DENTUPAC activity at a global level are limited. European dental schools implemented a modest smoking policy in 1993, and students in most schools were expected to record patients' smoking history [25]. DENTUPAC programs were reported in Canadian dental schools in 1998 [26]

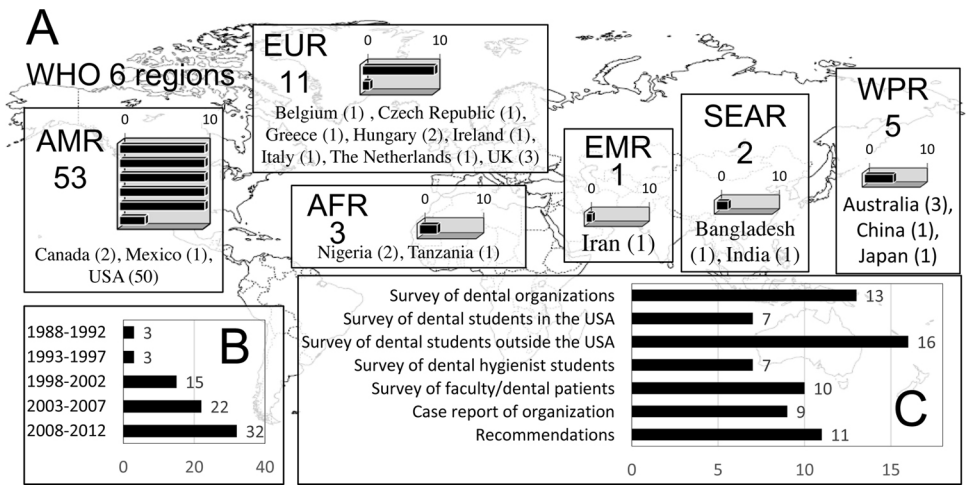

Figure 1 Summary of selected literature for distribution by the six regions specified by the WHO (A), periods of published year (B), and representative subjects (C).

and in UK dental schools in the early 2000s [27,28]. DENTUPAC models were developed at the first European dental workshop in 2005 [29].

Dental students in Ireland [30], India [31], and Tanzania [32] had a strongly positive attitude towards involvement in tobacco use interventions, and students in Nigeria [33,34], Iran [35], and Bangladesh [36] were at least aware of the necessity of DENTUPAC. Despite the considerably high rate of students who smoked, attitudes toward tobacco use interventions were relatively positive in Greece [37], Italy [38], and Hungary [39]. This positive attitude among dental students was also present in Japan, despite failure to follow public policy [40]. Consistently positive attitudes toward tobacco use interventions in surveys have confirmed the global demand for DENTUPAC [5,41].

4. Dental education for tobacco use interventions

4.1. Barriers and facilitators

Given that educational settings generally include on-campus clinics, barriers that had been identified in intervention practice in a dental setting [2] were also included in DENTUPAC, as follows: lack of confidence in knowledge and skill for intervention [34,42—45], resistance and low interest of patients [42,44,46], time constraints in dental practice [34,44], students' personal doubts over the efficacy of their counseling [42], and lack of patient education materials [34]. The most important barrier specific to DENTUPAC was related to organizations. This barrier was common across multiple specialties due to various education specialists being required [47], reduced confidence of faculty members in the program's efficacy [20], and lack of recognition by dental school deans [48].

Information regarding successful initiatives has been shared to further improve efforts toward tobacco use interventions, and challenges as well as potential facilitators have been reported during implementation of DENTUPAC into curricula (Table 2). Such facilitators for students were the positive attitudes and experiences of other students in intervention [43,49] and acceptance of intervention by patients in student clinics [16]. Review of educational methods and contents for future DENTUPAC programs also encouraged post-graduation intervention [44]. Faculty development (FD) programs, which also facilitated DENTUPAC [49], helped faculty members overcome some barriers

Table 1 Development of dental education of tobacco use prevention and cessation (DENTUPAC).

Stage	Year	Global diffusion	Quality of education
I	1989	Introduction and dissemination in US dental schools	Smoking restriction policy in dental schools enforced necessity of tobacco use intervention and modification of modules from didactic education to clinical training
II	2000	Progression in US and expansion to Europe	Development of educational contents and methods in US dental schools
III	2005	Reassessment of programs in US and global expansion	Inclusion of DENTUPAC in the European dental workshop for tobacco use intervention and proposal of competency for moderate-level intervention
IV	2010	Worldwide development	Global survey of dental education and extension of DENTUPAC for periodontal patients

Table 2 Barriers and facilitators of dental education regarding tobacco use prevention and cessation (DENTUPAC).

Subject	Barrier	Facilitator
Students	Low confidence in own knowledge and skill, time constraints, and doubts about effectiveness of counseling	Positive attitudes toward intervention and experience with intervention practice
Patients	Resistance and low interest	Receptiveness of patients to interventions in student clinics
Faculty members	Lack of recognition of program's importance	FD programs
Organizations	Lack of patient education materials and requirement of multiple specialties that may require various education specialists	Evidence of harm of tobacco use and government-provided programs for training

to clinical education, such as time management [20,50,51], availability of educational materials across multiple specialties [50], sufficiently fulfilling DENTUPAC lessons for the number of curriculum hours allocated for students to achieve confidence in moderate-level intervention [21], provision of appropriate mentoring [52], and lack of confidence in the efficacy of DENTUPAC [50]. Evidence of the harm of tobacco use and availability of governmental programs for training practitioners in tobacco use interventions also facilitated the adoption of DENTUPAC by those overseeing dental education [10].

Another facilitator for DENTUPAC implementation was attitudes among freshmen regarding the importance of their role in intervention [53] and discouragement of tobacco use among students [38]. Awareness of potential coverage of tobacco use interventions in academic dental clinics may also function as a facilitator in a primarily employer-based health insurance system, as this may encourage more insured persons to seek intervention [54].

4.2. Educational contents and methods, and evaluation of competency

Didactic education on tobacco pathology of oral diseases was predominant before the introduction of DENTUPAC into curricula. Characteristics of DENTUPAC programs were comprehensive for multiple specialties [38,47] and competency-based [20,45—47,52]. Incorporation of evaluation and feedback regarding specific experiences in tobacco use interventions has helped improve patient care delivered by students following graduation [18,55].

Major components (Table 3) of the clinical program, which were mainly based on the NCI training program in the US [10,56—58], were derived from the Treating Tobacco Use and Dependence Guidelines, which begin with two key questions: ''Do you smoke?'' and ''Do you want to quit?'' Intervention regimens according to the willingness of the patient have been implemented in DENTUPAC [20,43,59,60]. Brief intervention (<10 min) as described in the latest guidelines, which was frequently mentioned in literature published during Stages I and II of development, are composed of the 5 As, 5 Rs, and motivational interviewing (MI). MI has been described extensively in literature published during Stages III and IV of development [56—58,60—64]. Counseling and medication options are also included in the regimen for patients willing to attempt to quit smoking at the time of intervention.

Major contents presented at FD workshops include biological effects [29], psychosocial aspects of smoking such as stages of behavioral change [29,43,59], treatment of tobacco use and dependence [23,29,58], and counseling skills [23,57]. The American Dental Education Association has recommended key components for the DENTUPAC program [65]. While DENTUPAC generally targets all patients [59], intensive intervention education has targeted periodontal patients [63], and a smoking prevention and cessation program targeted adolescents in the community [66].

Students require lectures, problem-based learning (PBL), and e-learning to obtain a knowledge base and clinical instruction and practice to obtain clinical skills [29,43,58]. Objective structured clinical examination (OSCE) using standardized patients (SPs) has proven consistently successful in DENTUPAC training [44,57,62,63], except with one-time education for freshmen [67]. Video feedback [61,62,68] and group framework for the PBL [62] have also proven effective in the practical preparation of MI.

Confidence in intervention was improved by a case presentation of a patient who resisted quitting tobacco during OSCE training [57,59] and mentoring by experienced faculty members [69]. Although interactive CD-ROM training increased satisfaction with clinical competency [56] and an online tobacco module improved knowledge, the effects of this module on intention to intervene and confidence in implementing intervention in the future were limited [70]. The OSCE method has proven consistently successful for evaluating the competency of tobacco use interventions [44,57,62,63]. A checklist recorded by the SP was available for evaluation [67]. Records of assigned patients were used to evaluate the understanding of MI-related techniques [60].

4.3. Assessment of educational program

Objective variables such as frequency of counseling [46,47,61,68,69] and improvement of knowledge [57,68,70] in students were frequently used to assess the efficacy of the DENTUPAC program in preparing students for intervention. Subjective variables such as the attitude of students were

Table 3 Representative components in dental education regarding tobacco use prevention and cessation (DENTUPAC).

Component	Presentation/mode	Item
Contents	Clinical guidelines	5 As, 5 Rs, motivational interviewing (MI), and options of counseling and medication
	FD workshops	Biological effects, psychosocial aspects of smoking including stages of changing behavior, treatment of tobacco use, and dependence and counseling skills
Methods	Knowledge base	Lecture, problem-based learning (PBL), and e-learning
	Clinical skills	Clinical instructions and practice and objective structured clinical examination (OSCE) using standardized patients
	Modules	Video feedback, group framework for PBL, case presentation, mentoring, interactive CD-ROM training, and online tobacco module
Evaluations		OSCE method, checklist recorded by standard patients, record of patient assignment, and case notes using the subjective, objective, assessment, and plan (SOAP) format

examined to determine their confidence [45,71], readiness [45], and perception of personal role in intervention [47,71] and time constraints [47]. Variables were selected to assess the contents and methods of education. Receptiveness and comfort in achieving intervention despite resistance of patients, as well as behavioral intentions of students were assessed by the OSCE method [57]. Effects of additional mentoring were evaluated to improve confidence and counseling skills [69].

DENTUPAC programs have been assessed from multiple points of view. For example, records of case notes using the subjective, objective, assessment, and plan (SOAP) format over an eight-year period have been used to reassess the program as part of its maintenance policy [58]. In addition, instead of students, patients have been surveyed to determine the frequency of intervention received [26] and attempts to quit smoking [68]. The frequency of these practices for periodontal patients and other dental patients have also been compared to evaluate the effects of tobacco use intervention training with respect to actual intervention [59], which might be useful for estimating the impact of future intervention after graduation on public health.

5. Recommendations

5.1. Program

The DENTUPAC program can be organized to ensure that students recognize tobacco use interventions as part of standard dental care [72]. An effective program with feasible content and methods should be implemented with efforts to remove barriers to effective intervention from both clinical and public health points of view. However, early commencement of higher-level education should be avoided due to the difficulty of implementation and maintenance of the program. Emphasis on the significance of DENTUPAC and stepwise, flexible introduction might remove a number of barriers [65]. However, cooperation by the institution and faculty members might also be required to adjust the program used in existing curricula, due to its multidisciplinary nature [72]. Development of a global standard in dental settings and an educational model for comprehensive, multidisciplinary intervention are required [33,36,41]. Dental students are expected to competently administer moderate-level interventions to help prevent non-communicable diseases via the common risk factor approach.

5.2. Faculty development

Several papers have addressed the importance of FD training. Clinical practice guidelines in the US successfully informed dental faculty members of the priorities for ensuring the competency of students in tobacco use interventions [43]. Seminars targeted at multiple professions may facilitate the understanding of common methods of tobacco use interventions [65]. MI skills as well as available smoking cessation medications have been emphasized in training seminars [23,58,72], and web-based training might further supplement faculty-based training [65]. Presentations of successful cases may also offset insufficiencies in training and help faculties compensate for time constraints in the curriculum [65].

5.3. Organizations

The DENTUPAC curriculum involves elements of multiple disciplines. Educational organizations should therefore encourage the relevant faculty members and staff in charge of educating students to understand these elements in DENTUPAC themselves in order to ensure that students are competent in delivering moderate-level interventions [72]. To this end, resources should be provided to busy faculty members to facilitate commitment to the program [51]. Organizations may urge faculty members to attend lectures on tobacco use interventions [23] and should appoint a program coordinator to ensure that the quality of DENTUPAC training is consistent [58]. FD workshops might help

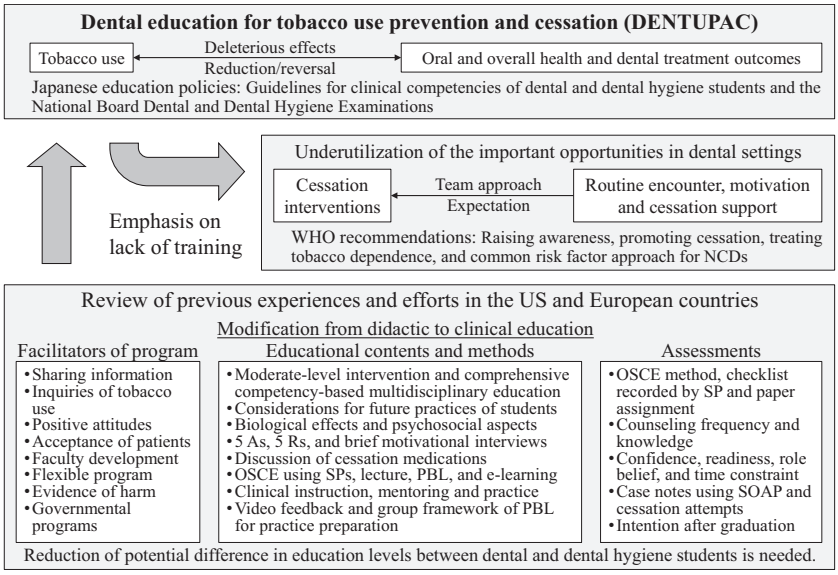

Figure 2 Strategy for planning dental education programs regarding tobacco use prevention and cessation.

overcome barriers such as the multidisciplinary characteristics of such education [58,65], as the comprehensive nature of the program might require a range of knowledge and skills as well as employment of part-time teachers for specific content [29]. The American Dental Education Association has detailed funds available to member schools to encourage participation in FD workshops [65].

Smoking is causally related to health disparity in developed countries. Dental education organizations, which are also regional health institutions, are primarily responsible for the implementation of DENTUPAC and reduction of this disparity [65]. These organizations should therefore also be responsible for relating previous experiences in tobacco use interventions to students of other disciplines with the support of reliable faculty members [18,56,73]. Dental educational organizations may additionally consider sharing their public health principles with other health-related organizations [5].

6. Conclusions

6.1. Conclusions for global development

The positive influence of dental education on efficacy of intervention for tobacco use cessation in a dental setting is internationally recognized. Analyses of the content and methods for improving education further suggest that the OSCE with SPs via utilization of motivational interviewing is a promising strategy for acquiring clinical competency in moderate-level interventions. Summaries of experiences and analyses of the influence of intervention on public health may help educators ensure the proper implementation of this important curriculum.

Attaining the desired national health objectives requires widespread dental education of the public. However, a number of barriers remain, hampering dissemination of information such as potential gaps between dental and dental hygiene education. Establishment of general objectives for acquiring clinical competency in achieving moderate-level interventions will help educators and students overcome such barriers.

Previous efforts and experiences regarding the development and dissemination of DENTUPAC might increase the number of interventions made by dental professionals following graduation. Although most dentists (76%) reported that they counsel patients [74], levels of intervention by dentists on quitting smoking reported by smokers are still relatively low compared to those by physicians, coming in at 12% for giving advice [75] and 25% for delivering simple assistance [76] in the US. These findings indicate the need for system-level changes in dental intervention, including further improvement of DENTUPAC by utilizing an appropriate model to evaluate the potential public health impact of education on tobacco use interventions.

6.2. Specific program planning in Japan

DENTUPAC has recently been adopted in Japan as a part of the model core curriculum of both dental and dental hygiene education, as well as in the Standards of the National Board Dental and Dental Hygiene Examination. Intervention to motivate smokers in dental settings might contribute to achievement of the numerical objective for decreased smoking rate, as mentioned in the second term of the ''National Health Promotion Movement in the 21st Century (Health Japan 21, 2nd term)''. The nationwide implementation of DENTUPAC training in dental schools is an urgent and important issue. A survey of dental schools in Japan may help clarify current attitudes and practices regarding DENTUPAC, furthering development of education on the subject. A strategy for planning and improving DENTUPAC training based on the present review is summarized in Fig. 2.

With the incorporation of treatment by physicians for nicotine dependence into the universal health insurance system in Japan, dental patients hoping to stop smoking can

now be referred to a physician. However, dental intervention as primary preventive dental care is not covered by the insurance system in Japan at present. Clarification of the response of periodontal pathogens to smoking cessation might support the coverage of effective intervention by the universal health insurance system in Japan. For example, smoking adversely affects periodontal microorganisms via an unhealthy shift in oral biofilms, including uncultured microflora [77,78] and increases the virulence of certain periodontal pathogens via pathways such as reduced immune responses [79,80]. Notably, plaque control regimens for the treatment of periodontal diseases have already been established in dental education curricula and the Japanese insurance system. Positioning tobacco use interventions as a modality of biofilm control might help ensure the program's development and rapid dissemination in dental curricula in Japan.

Conflicts of interest

No conflicts of interest are declared in relation to this manuscript.

Acknowledgements

This study was supported by grants from Fukuoka Dental College and the Japanese Society for Oral Health, and by JSPS KAKENHI Grant Number 24593182.

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